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Early-Cut Hay and Silage: Costs and Returns

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The effect of time of cutting on forage quality and eventually on milk production has encouraged many people to advocate early-cut forage programs. The value of a liberal supply of roughage as a low-cost feed and the recent awareness of time of cutting as an important factor in forage quality have also stimulated the need for developing an overall management program for the growing, harvesting, storing, and feeding of forages.

Before intelligent management decisions can be made about a change in the production and feeding of forages, a clear understanding of the probable consequences of such a change is essential. In relation to time of cutting, it is important to know the amount as well as the direction of change that might occur both in forage production and milk production. Although increased milk production will undoubtedly increase returns, a decrease in forage production will surely add to the feed costs.

The purpose of this study is two fold: to establish some guides, in the form of production relationships, that can be used for analyzing the effects of advancing or changing the time of cutting first-growth forages; and to evaluate the effect of advancing the date of cutting on feed costs and milk returns for some representative New York farms.

Because the following terms have a variety of meanings for different people, they are defined here to avoid possible misinterpretation.

Harvest pattern refers to the period during which the first-growth forage is cut. For simplicity, the harvest pattern is divided into 10-day intervals, and all analyses of milk production and forage production are based on the amount of forage harvested in each 10-day period.

Advancing the time of cutting involves a change in the existing harvest pattern whereby a higher percentage of early-cut forage is produced. This can be achieved either by beginning earlier in the season or by harvesting more of the crop in a shorter period of time. Any major change in a harvest program involves both an earlier and a more concentrated harvest pattern. In each study of a representative harvest pattern for advancing the date of cutting, both possibilities were considered. Each succeeding pattern, therefore, begins at an earlier date and is finished in a shorter period of time (table 1).

TABLE 1. HARVEST PATTERNS ESTABLISHED FOR EVALUATING THE EFFECT OF ADVANCING THE DATE OF CUTTING FIRST-GROWTH FORAGE

Harvest pattern	Date of cutting advanced	First cutting started	First cutting one-half completed	Length of harvest season
	days			*days*
1	0	June 15	July 10	45
2	5	June 12	July 5	41
3	10	June 9	June 30	38
4	15	June 6	June 25	34
5	20	June 3	June 20	31
6	25	June 1	June 15	28

An intensive study of the forage programs on 21 New York dairy farms in 1958 and 1959 revealed first-growth harvest patterns that were from 30 to more than 50 days long. The most common date at which half of the first-growth harvest had been completed was in early July. Because of less favorable drying conditions, especially in June, the first half of the harvest season was generally longer than the second half.

A basic harvest pattern from which to evaluate a change in time of cutting was established as 45 days long, extending from June 15th to July 30th. Half of the first-growth harvest was considered to be completed on July 10. A sequence of earlier harvest patterns was established, in which each successive pattern advanced the point of half completion by five days. For example, the sixth harvest pattern was considered to start June 1, be half completed on June 15, and finished by June 28th (table 1).

BASIC PRODUCTION RELATIONSHIPS

Milk Production and Time of Cutting

Numerous controlled feeding experiments on roughages cut at varying stages of maturity have been conducted by the Department of Animal Husbandry at Cornell University. Each of these experiments has shown a definite advantage for early-cut forage over late-cut forage in producing milk. A summary of the results from these experiments is given in table 2.

The individual findings in each experiment, although showing the same general relationships, varied widely. For example, W. Carter[1], in explaining the wide difference between performance on early and late-cut hay, noted that the late-cut, field-cured hay was subjected to "fairly severe weathering." This

[1] Carter, W. R. B. *Nutrient Losses and Feeding Value of Forage Harvested and Stored as Wilted Silage, Barn-Dried Hay and Field-Cured Hay.* Thesis (MS) Cornell University, 1957.

TABLE 2. SUMMARY OF MILK PRODUCTION TRIALS ON FIRST GROWTH FORAGE (Twenty-Week Duration, Cornell University, 1950-58)

Source	Type of forage	Cutting date	Average production per day*
			pounds
I. Egermeier** 1957, 1958	Silage	June 3, 4, 5, 6	49.8
	Barn-dried hay	June 3, 4	42.2
	Field-cured hay	June 30 - July 1	34.6
II. Carter† 1956	Silage	June 11, 12	44.6
	Barn-dried hay	June 11, 12	40.8
	Field-cured hay	July 9	27.5
III. Caballero‡ 1952, 1953	Silage	June 8 - 13	37.4
	Barn-dried hay	June 8 - 10	37.7
	Field-cured hay	July 6 - 8	32.4
IV. Trimberger§ *et al.* 1950, 1951	Silage	June 1, 7	44.7
	Barn-dried hay	June 15, 18	40.0
	Field-cured hay	July 5, 10	37.6
	Silage	July 5, 10	38.1

*Corrected to a 4 percent butterfat basis.

** Egermeier, J. C. *The Feeding Value of Forage for Milk Production as Affected by Harvesting Method and Stage of Maturity.* Thesis (MS) Cornell University, 1959.

† Carter, W. R. B. *Nutrient Losses and Feeding Value of Forage Harvested and Stored as Wilted Silage, Barn-Dried Hay and Field-Cured Hay.* Thesis (MS) Cornell University, 1957.

‡ Caballero-Delphino, J. H. *The Effect of Curing Methods and Time of Cutting Upon the Feeding Value of Forage.* Thesis (PhD) Cornell University, 1954.

§ Trimberger, G. W., Kennedy, W. K., Turk, K. L., Loosli, J. K., Reid, J. T., Slack, S. T. *Effects of Curing Methods and Stage of Maturity Upon Feeding Value of Roughages. Part I. Same Levels of Grain.* Bulletin 910. Cornell University Agricultural Experiment Station, Ithaca, New York.

hay was cut on July 9 but not stored until July 17 and 18. The earlier experiments were conducted on a change-over design, with the cows rotating every five weeks to a different roughage. In these experiments grain was fed at a uniform rate to all cows. A grain to milk ratio of 1:4 was established during a standardization period; then each cow's daily feeding of grain was decreased at the rate of 0.3 pound each week throughout the experiment. In the last two experiments, grain feeding was adjusted each week to the individual cow's production level, and each cow was fed only one quality of roughage during the 20-week experimental period.

The superior performance of grass silage as compared to barn-dried hay is of special interest. However, sufficient data have not been compiled to make a positive statement on this relationship.

Using these experimental results as a basis, and taking into account the various conditions under which each experiment was conducted, an estimated relationship between time of cutting and milk production was developed (table 3). This estimated relationship provides for an annual production of 12,000 pounds

TABLE 3. ESTIMATED ANNUAL MILK PRODUCTION FOR COWS FED ON ROUGHAGES HARVESTED IN DIFFERENT TIME PERIODS (Central New York Dairy Farms, 1960)

Date of cutting forage	Pounds of milk produced*	Pounds of grain fed
June 1 - 10	12,000	3,000
June 11 - 20	11,400	2,850
June 21 - 30	10,800	2,700
July 1 - 10	10,200	2,550
July 11 - 20	9,600	2,400
July 21 - 30	9,000	2,250
Second cutting	11,100	2,775

* Based on a potential decrease in milk production of 15 percent from cows fed hay cut in early June to cows fed hay cut in early July with grain fed at a 1:4 ratio. All second cutting is shown at only one production level. This is not based on actual feeding experiments but on digestibility trials which show that aftermath cuttings are similar in the percent of digestible dry matter to first-growth forage cut about June 20.

of 3.7 percent milk from large cows kept under good management conditions when forage harvested in early June is the only roughage fed. The estimated production decreases to 10,200 pounds of milk per cow when only forage harvested in early July is fed. These relationships assume grain fed at a grain to milk ratio of 1:4. This decrease in production (1800 pounds), when expressed as a percentage of the estimated production for early June hay, shows a decline of 15 percent in milk production as the result of feeding hay cut a month later.

Part of the decrease however, is caused by a lower grain intake. This is a conservative estimate when compared with the results reported in the first two experiments in table 2 which show a decrease in production of 21 percent and 35 percent respectively when cows are compared on the basis of similar months. In each of these experiments, grain was fed at two different ratios, 1:4 and 1:8. The milk responses reported in these two studies represent an average of the two feeding levels. In the earlier studies, grain feeding was established at a 1:4 level during a standardization period immediately preceding the feeding trial and then decreased 0.3 pound per week. Under this grain-feeding schedule, which was not adjusted for milk production, decreases in milk production of 15 percent and 9 percent were shown in the results reported in experiments III and IV in table 2.

Data developed by C. R. Hoglund[2] at Michigan State University are in close agreement with this relationship. He estimated annual milk production for high quality Holstein cows consuming excellent roughage to be 13,615 pounds when fed 3500 pounds of grain. Milk production was estimated at 11,870 pounds

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[2] Hoglund, C. R. *A Budgeting Guide in Estimating Milk Production when 1,200 Pound Holstein Cows are Fed Variable Quantities of Grain.* Agricultural Economics Report 670, Michigan State University, January 1957.

with poor quality roughage when fed 3000 pounds of grain. Both responses represent approximately a grain to milk ratio of 1:4. Excellent quality roughage was defined as containing a high percentage of legumes harvested in early bloom. Poor roughage was defined as containing a small percentage of legumes and harvested in a late-to past-bloom state. If the difference in bloom stage described here occurred over a period of three weeks, then the drop in potential milk production would be 18 percent for a month's delay in cutting. If this were a four-week period the percentage drop would be 14 percent. In either case, the relative milk response from forages cut at different dates would be similar to the relationship established in this study.

Estimates from staff members in the Department of Animal Husbandry at Cornell indicate that the relative response of the cows in their experiments to roughages cut at different times is applicable over a full lactation. There is some evidence that late in a lactation, when milk production is reduced, the early-cut forage might bring about an even greater relative change in production.

Forage Yield and Time of Cutting

It is a well-known and noticeable fact that starting harvest in early June will reduce the yield of first cutting on most fields. Because of this loss in yield and the generally unfavorable drying conditions in June, many farmers are reluctant to cut their forage crops early. The loss of total yield (first and later cuttings) on fields not cut until July is less well recognized. It is now generally accepted knowledge that to obtain the highest total yields it is best to harvest the first crop during mid-June.

Increased attention must be given to the management of forage programs if high quality forage in liberal amounts is to be available throughout the year. Such programs allow for increased feeding of supplemental roughage to cows on pasture. Additional forage can be provided in many forms, including hay or silage from storage and modifications of zero grazing that involve green chop or more intensive use of aftermath and other summer pasture crops.

On many farms, very little forage growth is left unharvested; therefore, attention is focused on total yield and not on the first cutting alone. For example, if early cutting means less harvested roughage, it can also mean more aftermath feed for green chop or grazing and therefore less harvested roughage is needed for feeding during the summer.

Many sources were explored in an attempt to determine satisfactorily the nature of changes in yield (both first and aftergrowth) as the date of first cutting is advanced. Current research in the Department of Plant Breeding at Cornell University provided valuable information on the growth patterns of

TABLE 4. RELATIONSHIP OF TIME OF FIRST CUTTING TO TOTAL YIELD FOR SELECTED FORAGES*
(Central New York Dairy Farms, 1960)

Date of first cutting	Yield: First cutting	Yield: After growth	Yield: Total
	tons of hay equivalent per acre		
Naragansett Alfalfa:			
June 1 - 10	1.61	2.12	3.73
June 11 - 20	2.00	1.87	3.87
June 21 - 30	2.28	1.50	3.78
July 1 - 10	2.34	1.14	3.48
July 11 - 20	2.28	.83	3.11
July 21 - 30	2.22	.71	2.93
Viking Trefoil:			
June 1 - 10	1.43	1.85	3.28
June 11 - 20	1.70	1.66	3.36
June 21 - 30	1.88	1.40	3.28
July 1 - 10	1.95	1.03	2.98
July 11 - 20	1.90	.65	2.55
July 21 - 30	1.85	.53	2.38
Common Timothy:			
June 1 - 10	1.30	1.03	2.33
June 11 - 20	1.57	.94	2.53
June 21 - 30	1.80	.69	2.49
July 1 - 10	1.83	.41	2.24
July 11 - 20	1.69	.17	1.86
July 21 - 30	1.60	.12	1.72

* Based on unpublished data from the Department of Plant Breeding, Cornell University. Yields of first cuttings through June and the aftermath production are based on field trials. Yields after this period are projections from the measured data. C. C. Lowe and W. L. Griffeth assisted with the interpretation of the basic information.

various legumes and grasses. In these experiments, systematic first cuttings were made each week from pure species stands throughout the early harvest season. Supporting research results on the regrowth characteristics of various forage species were also available from the Departments of Plant Breeding and Agronomy.

Members of these departments were consulted for interpretations of the research findings and for advice in areas where research was nonexistent. This information was combined with farmer experience obtained in the previously mentioned forage study and in other studies conducted to discover relationships between time of cutting and yield responses. The resulting relationships, therefore, represent not a report of research results, but as accurate an interpretation of various research findings to practical farm conditions as was possible.

Because climate, elevation, and soil resources vary considerably from region to region and often from farm to farm, it was necessary to define the resource base on which the yield relationships shown in table 4 were developed. The

greatest body of research has been done at Ithaca, New York. However, the results should apply to much of Central New York State without much modification.

Estimated yield responses

The following assumptions were made in establishing the relationship of time of first cutting to total yield:

1. The crops were grown under better than average management conditions with the use of currently recommended forage practices. The results will not apply to poor or inadequately fertilized stands.

2. Soils ranged from somewhat poor to well drained. The pH was 6.5 or above. Elevation was assumed to be between 800 and 1200 feet above sea level. Extremes in elevation or climate would shift these relationships a few days earlier or later, but should not materially alter the relative nature of the yield responses.

3. Regrowth was harvested within a reasonable period of time after the first cutting was removed. Regrowth is generally available for harvest as follows: Narragansett alfalfa, six to seven weeks; Viking trefoil, six to seven weeks; common timothy, assumed to be harvested with legumes.

4. The yield estimates cover the period from first harvest to September 1 and represent all forage removed from the field as well as unharvested growth remaining on September 1.

The relationships of time of first cutting to total yield for alfalfa, trefoil, and timothy were combined in table 5 to show the effect in a selected farm situation. This relationship will be used later in a budget analysis.

TABLE 5. RELATIONSHIP OF TIME OF FIRST CUTTING TO TOTAL FORAGE YIELD ON A FARM SITUATION WITH ACREAGE DIVIDED, 50 PERCENT GRASS, 30 PERCENT ALFALFA, AND 20 PERCENT BIRDSFOOT TREFOIL*
(Central New York Dairy Farms, 1960)

Date of first cutting	Yield: First cutting	After growth	Total
	tons of hay equivalent per acre		
June 1 - 10	1.42	1.52	2.94
June 11 - 20	1.73	1.36	3.09
June 21 - 30	1.96	1.07	3.03
July 1 - 10	2.01	.75	2.76
July 11 - 20	1.91	.46	2.37
July 21 - 30	1.84	.38	2.22

* Based on unpublished data from the Departments of Plant Breeding and Agronomy, Cornell University. C. C. Lowe and W. L. Griffeth assisted with interpretation of these data. See footnote to table 4.

Forage Consumption

Both farmer experience and experimental results show that cows will consume high quality, early-cut hay in substantially greater quantities than later-cut hay. This was demonstrated in the controlled experiments at Cornell University summarized in table 2. In these experiments, cows consumed from 30 percent to 40 percent more of the hay cut in early June than that cut in early July. Therefore, in addition to considering yield changes as the time of cutting is advanced, it is also necessary to allow for changes in the total roughage requirements.

Part of the increased consumption is offset by a more complete utilization of the early-cut forage. However, there are no direct experimental results that have indicated an answer to the question of what happens to feed refusal as the time of cutting is changed. In the milk production experiments at Cornell, the amount of roughage refusal (waste) was controlled to prevent the cows from doing too much selective feeding. Even under these controls, however there was about a 10 percent refusal rate on hay cut in early June.

In a budgetary analysis for the Central Plain Region of New York State, forage refusal rates of 10 percent for excellent quality hay, 20 percent for medium quality, and 30 percent for poor quality hay were used.[3] These values were based on dairy farmer observations and judgments of the staff in dairy husbandry.

For the purposes of this analysis, forage consumption was expected to increase 30 percent when hay harvested in early June was substituted for that harvested in early July. Refusal rates were estimated at 10 percent for early June, with an increase of 5 percent for each 10-day period cutting was delayed. Therefore, if cows were fed liberal amounts of hay cut in late July, they would refuse to eat about 35 percent of the hay.

Production Costs

Increased milk production resulting from changes in harvesting programs involves added costs as well as benefits. The direct costs associated with producing more milk, such as additional grain and milk hauling and cooling are not large.

The costs associated with an earlier harvest can be much greater. They may involve new harvesting machinery such as balers, choppers, and hay conditioners, or storage facilities such as silos and mow driers. Additional harvesting labor may also be involved. However, on some farms an early harvest may be attained through timely and more efficient use of the present resources.

[3] Hess, C. V. *Farm Budgeting Reference Manual*, A. E. Res. 15, Department of Agricultural Economics, Cornell University Agricultural Experiment Station, April 1959.

TABLE 6. ESTIMATED ANNUAL COSTS OF OPERATING SPECIALIZED EQUIPMENT FOR HARVESTING AND STORING FORAGE (New York Farms, 1960)

Item	Tons of hay equivalent processed*				
	35	70	100	150	200
	Total annual operating costs				
Hay conditioner	$167	$190	$212	$246	$280
Forced air mow drier					
36-inch fan (1 unit)	108	141	—	—	—
36-inch fan (2 units)	—	—	244	292	—
42-inch fan (1 unit)	—	170	202	—	—
Hay baler, twine tie					
PTO	390	449	501	582	665
Auxiliary motor	472	536	591	678	767
Field chopper					
PTO	477	539	594	678	762
Auxiliary motor	574	638	695	781	868

* Assuming a yield of 1.8 hay equivalents per acre.

Costs of owning and operating several items of specialized harvesting equipment and storage systems were budgeted for different sizes of business. These include both the fixed and variable costs one might reasonably expect to occur under production levels of 35, 70, 100, 150, and 200 tons of hay equivalent harvested per season. A summary of this information is given in table 6.

Similarly, annual storage costs for silos were budgeted at levels of 84, 138, 180, and 248 tons of silage capacity. This information is presented in table 7.

Costs apply only to the operation and use of the particular item, including necessary drive and mobile power where appropriate. They do not reflect the subsidiary costs such as labor for loading, transporting, and storing forages. These latter costs will vary considerably depending on individual farm circumstances.

TABLE 7. ESTIMATED ANNUAL STORAGE COSTS FOR SILOS* (New York Farms, 1960)

Silo construction	Rated capacity in tons			
	84	138	180	248
	12x35	*14x40*	*16x40*	*16x50*
Poured concrete	$ 66	$ 82	$ 94	$109
Concrete stave	70	91	107	142
Wooden stave	81	104	119	—

* Includes depreciation, interest and repairs. Spoilage losses are not included because wilted silage produces about the same storage losses as field- or barn-dried hay.

ECONOMIC ANALYSIS

Costs and Returns from Feeding Early-Cut Forage

A set of important production relationships associated with advancing the time of cutting forages on dairy farms have been presented, and possible changes in production costs have also been noted. The net effect on income can now be examined for an actual farm situation.

Two kinds of costs can be increased: those associated directly with the production of milk, and those linked with the implementation of an earlier harvest system. Here each is considered separately. The costs directly associated with milk production, such as added grain and milk handling, are evaluated first in relation to changes made in milk and forage production to obtain a net change in the value of production on a farm with 48 cows. Then, these added returns are compared with the costs of various specialized harvesting and storing techniques. In this way the impact that each system must have on the forage program to justify its use will be shown.

Changes in milk production and concentrates fed on this typical farm are shown in table 8. These results assume that 60 percent of the annual forage requirement coming from the meadow land, including hay, grass silage, green chop, and aftermath pasture. The remaining 40 percent of forage would be in the form of corn silage, permanent or rotated pasture and other forage crops.

The prices applied were: milk, per 100 pounds, $4.50; concentrates, per 100 pounds, $3.50 and surplus forage, per ton, $10.00. The additional forage was valued considerably under prevailing market prices, since no additional expense was included for harvesting this slightly larger tonnage. The value for milk is just under the 1957-1959 average for New York State. Concentrates were valued at approximately market price for the same period of time.

TABLE 8. ESTIMATED RELATIONSHIP BETWEEN TIME OF FIRST CUTTING AND ANNUAL CHANGES IN MIILK PRODUCTION AND CONCENTRATES FED
(48-Cow Dairy Farm — Central New York, 1960)

Harvest pattern	First cutting* one-half completed	Change in: Milk production	Concentrates fed (1:4)
		pounds	*pounds*
1	July 10	—	—
2	July 5	+ 6,048	+1,512
3	June 30	+12,182	+3,046
4	June 25	+18,058	+4,514
5	June 20	+22,896	+5,724
6	June 15	+27,821	+6,955

* See table 1.

TABLE 9. NET CHANGE IN VALUE OF PRODUCTION WHEN DATE OF FIRST CUTTING IS ADVANCED
(48-Cow Dairy Farm — Central New York, 1960)

Added expense				Added receipts			Net change in value of production
Harvest pattern	Concentrates	Other*	Total	Milk	Surplus forage	Total	
1	—	—	—	—	—	—	—
2	$ 53	$18	$ 71	$ 272	$ 60	$ 332	+$ 261
3	107	37	144	548	130	678	+ 534
4	158	54	212	813	200	1013	+ 801
5	200	69	269	1030	230	1260	+ 991
6	243	83	326	1252	240	1492	+ 1166

* This is an estimated cost to cover milk hauling, milk cooling and other small expense items associated with the handling of a somewhat greater quantity of milk and feed.

The result of multiplying these prices by appropriate production figures for each of the six harvesting patterns is shown in table 9.

The data in table 9 indicate that it is profitable to advance the time of cutting until all of the forage is cut within the month of June (pattern 6). There is, however, a greater marginal return for initial improvements in each of the harvest patterns. This is the period in which total yield of forage increases most rapidly (patterns 2, 3, 4).

The net value of added production resulting from advancing the time of cutting does not reach a maximum even when all of the first cutting is done in June. However, with the difficulty farmers presently find in finishing all of one cutting in June, advancing harvest dates to that extent does not appear feasible.

The expenses in table 9 do not include the additional costs for special harvesting and storage equipment that may be necessary to advance the time of cutting. These expenses are discussed next.

Alternative Methods of Advancing Time of Cutting

Three possible methods for concentrating the harvesting period and reducing harvesting losses for first-growth forage are considered in some detail. These are the use of grass silage, mow driers, and hay conditioners.

Grass silage

Recent experiments (table 2) have demonstrated that good grass silage may be superior to hay in stimulating milk production. The analysis in this study is not based on a relative gain from the use of grass silage in place of hay, however, but on the ability of grass silage to provide a greater proportion of early-cut forage.

Because the use of grass silage involves varying degrees of capital expenditure on individual farms, four levels of investment were evaluated. If a forage harvester and silos were already available, the principal cost changes would result from increased use of existing resources. Part of these costs would be shifted from the present system to a larger grass silage program. Such a situation may exist on farms that presently use green chop feed as a pasture supplement and/or make corn silage. In this case, fixed costs were not charged for using the chopper or silo.

The three other levels of investment involve the addition of a silo, a chopper, or a silo and chopper together. In the situations involving the addition of a chopper, one-half of the fixed costs were allocated to other forage crops. Allowance was not made for possible cost changes that might occur in the loading, transporting, and storing of forages. The existing system was assumed to include a hay baler as the only major item of specialized harvesting equipment. A summary of the estimated cost changes for each of four different situations is given in table 10.

When all of the necessary equipment was already available, there was only a slight increase in costs from shifting more of the load to the chopper. A new silo added $137 to annual expenses, a chopper $228, and the two items together $330.

Each cost item in table 10 was subtracted from the equivalent income item in table 9. The results presented in table 11 show the increase in income that occurs when a switch to grass silage is made and the time of cutting is advanced by varying amounts.

An analysis of these net income figures shows that a five-day advance in the harvest pattern (pattern 1 to pattern 2) would more than cover the costs of adding a silo. Adding a chopper would probably require a 10-day advance

TABLE 10. ANNUAL CHANGES IN HARVESTING AND STORAGE COSTS WHEN GRASS SILAGE IS INCLUDED IN THE FORAGE PROGRAM*
(48-Cow Dairy Farm — Central New York, 1960)

		Annual operating costs for revised system when			
Cost item	Baler (PTO)	All equipment now available	Silo is added (wooden stave)	Chopper is added	Chopper & silo are added
Baler	$640	$550	$550	$550	$550
Silo	—	12	114	12	114
Chopper	—	113	113	306	306
Total	$640	$675	$777	$868	$970

* Cost of original system based on harvesting 185 tons of hay. The revised system would include 130 tons of hay and 165 tons of grass silage.

TABLE 11. CHANGES IN NET INCOME FROM ADVANCING THE TIME OF CUTTING BY HARVESTING GRASS SILAGE[*] (48-Cow Dairy Farm — Central New York, 1960)

Harvest pattern	First cutting one-half completed	No additional capital expense	Adding a silo	Adding a chopper	Adding a chopper and silo
1	July 10	−$ 35	−$137	−$223	−$330
2	July 5	+ 226	+ 124	+ 33	− 69
3	June 30	+ 449	+ 397	+306	+204
4	June 25	+ 766	+ 664	+573	+471
5	June 20	+ 956	+ 854	+763	+661
6	June 15	+1131	+1029	+938	+836

* See tables 9 and 10.

(pattern 1 to pattern 3) to justify the added expense. If both a chopper and silo were needed, a 10-day advance would be required on this 48-cow dairy farm.

If a farm were now only half through first cutting by July 10, and could change to have all the first cutting done in June, the addition of grass silage to the forage program would help increase net income from $836 to almost $1150 annually, depending on size of herd and equipment needed. If the date of cutting were not advanced, however, this change could result in a net loss of as much as $330 annually.

Hay Conditioners and Mow Driers

Farmers who rely primarily on a baler to harvest forage can choose several types of specialized equipment to help speed harvesting operations. The use of a hay conditioner saved an average of "at least a day" in curing time.[4] Kelsey and Stanton reported a day saved in field-curing time also when a mow drier was used.[5] The use of one or both of these harvesting methods will add directly to cost of hay production. Therefore, this cost must be matched by a similar increase in the value of the harvest hay. There are two potential values to be gained from the use of this equipment. It makes possible the harvesting of good quality forage during short periods of fair weather and reduces the chance of excessive field losses from weathering and leaf shatter.

The costs of operation developed in this study do not show a definite advantage for either the conditioner or the drier except at low production levels where a small drier can be operated more economically. On most farms the decision

[4] Conneman, G. J. and Bratton, C. A. *Operation of Hay Conditioners on 91 New York Farms 1957.* A. E. Res. 2, Department of Agricultural Economics, Cornell University Agricultural Experiment Station, Ithaca, New York.

[5] Kelsey, M. P. and Stanton, B. F. *The Operation of Forced Air Mow-Driers on New York Farms, 1956-1957.* A. E. 1040. Department of Agricultural Economics, Cornell University Agricultural Experiment Station, Ithaca, New York.

TABLE 12 CHANGES IN HARVESTING COSTS WHEN A HAY CONDITIONER OR MOW DRIER IS ADDED*
(48-Cow Dairy Farm — Central New York, 1960)

Cost item	Baler only (PTO)	Hay conditioner is used	Mow Drier is Used: Sixty percent of crop is mow dried	Mow Drier is Used: Eighty percent of crop is mow dried
Baler	$640	$640	$640	$640
Conditioner	—	270	—	—
Drier	—	—	215	290
Total	$640	$910	$855	$930

* Cost is based on harvesting 185 tons of hay.

about which piece of equipment to use will rest on the relative ability of each system to speed the harvesting operation and reduce harvesting losses. Unfortunately, neither of these practices has been used extensively or long enough to provide a comprehensive body of data for comparison.

Mow driers offer a greater latitude in intensity of use. In threatening weather, hay can be harvested while still quite damp. During extended periods of fair weather, more of the curing can be completed in the field and reduce the cost of operating the drier. The hay conditioner, however, must be used soon after mowing, allowing little discretion in its use during periods of fair weather.

Costs were computed on the basis of conditioning all of the hay crop. To evaluate two intensities of use, the amount of hay processed on mow driers was budgeted at levels of 60 and 80 percent of the total crop. The existing system was assumed to contain a baler as the only major piece of specialized harvesting equipment. The developed costs are shown in table 12 and the changes in net income resulting from the use of hay conditioners and mow driers are given in table 13.

TABLE 13. CHANGES IN NET INCOME FROM ADVANCING THE TIME OF CUTTING BY USING A HAY CONDITIONER OR MOW DRIER
(48-Cow Dairy Farm — Central New York, 1960)

Harvest pattern	First cutting one-half completed	Hay conditioner is used	Mow drier is used: Sixty percent of crop mow dried	Mow drier is used: Eighty percent of crop mow dried
1	July 10	$-270	$-215	$-290
2	July 5	- 9	+ 46	- 29
3	June 30	+264	+319	+244
4	June 25	+531	+586	+511
5	June 20	+721	+776	+701
6	June 15	+896	+951	+876

When only 60 percent of the crop is mow dried, a small positive return is shown for a five-day advance in the harvest pattern. When 80 percent is dried or when the hay conditioner is used, an advance of ten days in the harvesting pattern is required to justify the use of either item of equipment. There is no clear advantage shown in this analysis for the hay conditioner or the mow drier. Thus, the value of one in relation to the other would depend almost entirely on the effectiveness with which each could be integrated into a program to advance the time of cutting.

When hay conditioners and mow driers are compared with grass silage as alternative means for advancing the date of cutting, again the differences are not great. The grass silage program appears to be approximately equal or superior to the hay conditioner or mow drier for an equivalent advance in the time of cutting.

CONCLUSIONS

June is a critical month on most dairy farms. Advancing the time of cutting first-growth hay and forage is not easy. However, the gains in milk production and income from such an effort are clear if the added costs are not too great.

The costs associated with getting the job done will vary widely from farm to farm. In some cases additional equipment such as forage harvesters, silos, or mow driers and hay conditioners are necessary to advance the time of cutting.

On many farms organizing the work to be done is more important than adding equipment. Harvesting equipment must be serviced and ready whenever there is good weather in June. Some extra day labor may be needed to keep the balers and choppers going even at milking time. Careful planning and a willingness of all the crew to work overtime in this most critical month should pay off on most dairy farms.

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